INVESTIGATION OF COATINGS FOR LANGMUIR PROBES IN AN OXYGEN-RICH SPACE ENVIRONMENT. J. I. Samaniego[1,2,4], X. Wang[1,4], L. Andersson[4], D. Malaspina[4], R. E. Ergun[3,4], and M. Horanyi[1,2,4]. [1]NASA/SSERVI's Institute for Modeling Plasma, Atmosphere, and Cosmic Dust (IMPACT) at University of Colorado Boulder (3400 Marine St. Boulder, CO 80303 USA, josa3077@colorado.edu). [2]Department Physics, University of Colorado, Boulder CO 80303 USA. [3]Department for Astrophysical and Planetary Science, University of Colorado, Boulder CO 80303 USA. [4]Laboratory for Atmospheric and Space Physics (LASP), Boulder CO 80303 USA.

In the atmospheres and ionospheres of planets where there is high concentration of oxygen atoms/molecules and ions Langmuir probe measurements have been shown to distort. Most materials when oxidized form an electrically resistive layer on the surface of the probe that will reduce the current collected by a given probe's bias voltage. This reduction in current then changes the current-voltage (I-V) curves and the resulting measured plasma parameters (e.g. density, temperature, potential). TiN (Titanium Nitride), DAG (a resin based graphite dispersion), or Gold are the currently used coatings for Langmuir probes, yet they pose issues when exposed to an oxygen-rich space environment. Iridium and Rhenium are selected as new coating candidates because they strongly resist oxidization and remain highly conductive even in their oxidized forms. Here we present the oxidation effect on the measurements of Langmuir probes made of current coating materials (DAG, Gold, TiN) and new coating materials (Iridium and Rhenium) tested against control materials (Copper and Nickel) in the laboratory. An argon plasma chamber is used to compare the probe`s I-V curves before and after the oxidation process. The oxidation process is performed in an oxygen plasma chamber in which both O^+ and O_2^+ are created and accelerated toward the probe surface with the energies of 1.5 and 10 eV and the flux 10^{18} Ions m^{-2} s^{-1}. Our results show that the TiN and Gold probes have significant changes in their I-V curves after exposure to the oxygen plasma. DAG shows a small oxidation effect on the probe measurements but is known to erode over time due to gaseous oxidized forms. Iridium outperforms all the other testing materials with almost unchanged I-V curves after oxidation process. Due to its extreme hardness, Iridium is a suitable new coating material for future in situ Langmuir probes. Additionally, this new coating can be also applied for other plasma instruments in which the electrode surfaces pose a risk of being exposed to oxygen.

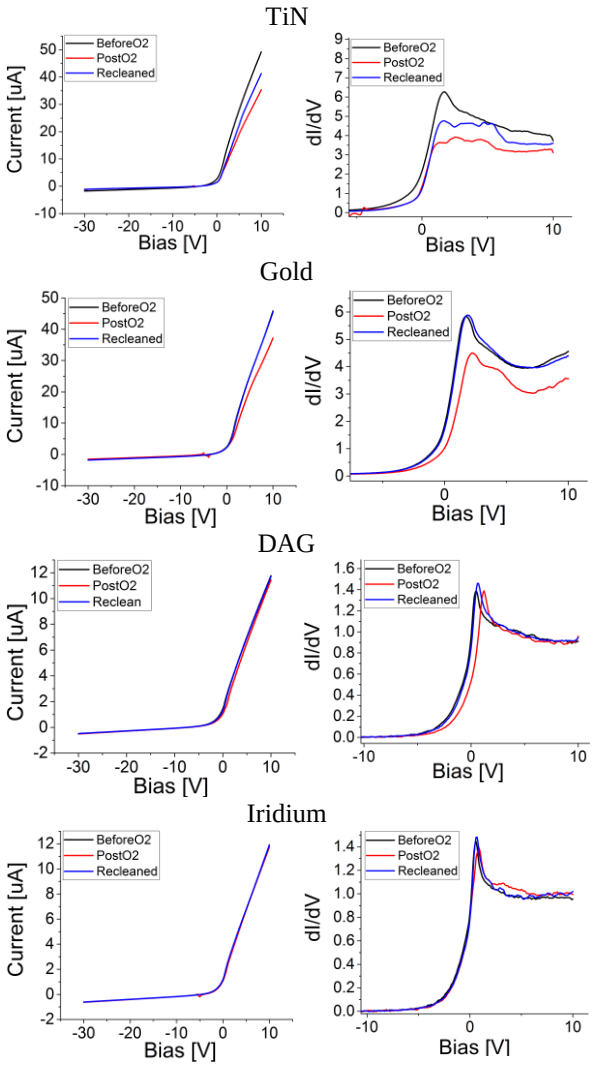

Figure 1: The I-V curves (Left) and first derivatives of I-V curves (Right) of TiN, Gold, DAG, and Iridium.